THE GLASS INDUSTRY

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TROUBLE SHOOTING AT SKYTOP

When the Glass Division holds its 11th summer meeting at Skytop, Pa., September 8 to 10, the members will give their concentrated attention to some of the work-a-day problems of glass making. The Friday session will consist of a morning devoted to papers on Cords and Stones, with an afternoon discussion of Chemical Analysis. On Saturday, the various aspects of Chemical Durability will hold the stage.

The greatest need of anyone attempting to write about cordy glass is some short, handy, Anglo-Saxon word meaning "inhomogeneity." Perhaps this forthcoming session will coin such a word, or at least it should, because the Greeks were not glass makers, and they should not have had all of the etymological fun.

Cords in opaque glasses become very conspicuous and ugly against their white background. Dr. Kreidl, of the Dunkirk Glass Works, a new-comer in the Glass Division, will deal with this interesting subject.

Dr. Weyl, of Pennsylvania State College, and Mr. Turnbull, of the Preston Laboratories, have taken a leaf from the biologist's book and applied some chemical staining methods to cordy glass for the purpose of bringing out colors which will serve to identify the composition of the cords. This method may provide a new post-mortem device for the detection of culprit components.

The ultimate in homogeneity is achieved in the production of optical glass. Fraser and Scott of the Bausch and Lomb Optical Company will make report and confession as to this approximate perfection, and will disclose some of the methods used in examining their superior product.

It seems altogether proper that glass stones commonly

The Skytop Club, where members of the Glass Division will meet, September 8th.

brought into glass by the surrounding refractories should be dealt with by purveyors. Thompson, of the Harbison-Walker Refractories Company, will attempt to explain why it becomes necessary to give these evil particles a chance to wander into the clear glass. Discus sion of these ever-present annoyances ought to be lively and informative. Whatever Glass Technology may accomplish in the way of accumulating facts about glass as a material, and the effect of composition on its essential properties, it seems that we shall always be confronted by these defects which arise from the nature of the containing walls, and from the reluctance of our viscous liquids to mingle thoroughly.

Louis Navias, secretary and liaison officer, will tell how Committee C-14 is getting on with the project of teaching the A. S. T. M. what a cantankerous and highly specialized material is ours.

In the afternoon, Dr. Lundell, who is one of the rare experts who is generously willing to share and thoroughly able to impart his knowledge and experience, will lead the discussion on Chemical Analysis. Any glasshouse chemist can profit more by participating in this round-table session than he would be able to do by hours of reading and study.

The Saturday morning session will be given to Chemical Durability. The several phases of this topic to be treated cover means of determining the quantity and character of substances extracted from glass, the behavior of glass toward different solutions, the corellation of rapid and slow tests, and specifications of durability for specific uses.

Thesis Work at Alfred, to be reported by Scholes, will deal with pH Determination as a substitute for the titrating of alkali.

Next comes a paper on Resistance to Alcoholic Solutions, by Bacon and Burch of Owens-Illinois. This may refer to unrefillable bottles, but more likely it will have to do with cloudiness engendered by gin.

If any of the accelerated tests will show in a few hours what is likely to happen after months of storage, all will want to know. Lyle, of Hartford-Empire, is apt to have the answer. Finn and his co-workers at the Bureau of Standards are again ready with new ways of finding out what goes into solution when glass is attacked. The customer is represented by Carter, of the Abbott Laboratories, who will say what the pharmacist demands as to the behavior of bottles toward solutions of delicate drugs.

Very roughly, this session ought to go far toward supplying the answer to the question, "When is a bottle good enough, and how does one know." There will be ample time for all present to come up with helpful contributions.

This entire program is built with an eye to the plant and control men. Every paper is of a distinctly practical nature, closely related to the glass-house problems of every day.

Papers to be read

On the morning of Friday, the eighth, there will be a sympoium on glass defects at which the following papers will be read and discussed:

1. Some Inhomogeneities in Opaque (fluorine and sulphide) Glasses, by N. J. Kreidl, Dunkirk Glass Works, Dunkirk, N. Y.

2. Staining of Glass, Some Possibilities in the Study of Inhomogeneities, by W. Weyl, Department of Ceramics, Pennsylvania State College, State College, Pa., and J. C. Turnbull, Preston Laboratory, Butler, Pa.

3. Homogeneity of Optical Glass, by W. Fraser and Murray Scott, Bausch & Lomb Optical Co., Rochester, N. Y.

4. Glass Stones, by C. L. Thompson, Harbison-Walker Refractories Co., Pittsburgh, Pa.

Saturday morning, the ninth, will be devoted to a symposium on the chemical durability of glass, with the following papers scheduled to be delivered:

1. pH Determinations as a Measure of Durability, by S. R. Scholes, Department of Glass Technology, New York State College of Ceramics, Alfred, N. Y.

2. Resistance of Glass Containers to Alcoholic Solutions, by Frank R. Bacon and O. G. Burch, Owens-Illinois Glass Co., Toledo, Ohio.

3. The Relations between Storage and Accelerated Chemical Durability Tests for Several Glass Compositions, by A. K. Lyle, Hartford-Empire Company, Hartford, Conn.

4. Some Observations on the Methods of Analysis Applicable to Solutions Obtained in Tests for Chemical Durability of Glass, by E. H. Hamilton, Donald Hubbard, and A. N. Finn, National Bureau of Standards, Washington, D. C.

5. Chemical Durability Requirements of Pharmaceutical Containers, by E. B. Carter, Abbott Laboratories, North Chicago, Illinois.

AMERICAN FELLOWS TO MEET

It is planned to hold a meeting and dinner of the American fellows of the British Society of Glass Technology during the summer meeting of the Glass Division of the A. C. S. Among the American fellows are George Morey, J. C. Hostetter, William M. Clark, Francis Flint, W. C. Taylor, E. W. Tillotson and Arthur Q. Tool. Details of this meeting will be announced at Skytop.

Relaxing at Francis Flint's summer cottage at Cove Point, Md., during the preparation of the Glass Division program. Left to right: Flint prepares breakfast and renders a roundelay. Lundell and Lester listen to the wild waves.

GLASS DIVISION PROGRAM DISCUSSED INFORMALLY

A dozen or so of the members of the Glass Division of the American Ceramic Society, including a number recently appointed to the several division committees by Chairman J. T. Littleton of Corning, N. Y., gathered early on October 5 at Washington, D. C., by invitation of Francis C. Flint of Washington, Pa., and motored to Mr. Flint's summer cottage at Cove Point, Md., near the lighthouse of that name on the western shore of Chesapeake Bay about 65 miles from the Capitol.

The primary purpose of the gathering was to hold an informal week-end discussion relating to the program for the annual meeting of the Glass Division next February at Toronto. Suggestions were also made as to methods for extending the activities of the Division, increasing its effectiveness and influence and promoting a greater interest on the part of the glass manufacturing industry in its activities.

The informal character of the meetings made it possible to discuss questions and arrive at conclusions with much more celerity than would have been possible at a formal gathering and at the conclusion of the event the experiment was heartily commended by those present.

In the party were: Francis C. Flint, Hazel-Atlas Glass Company, Washington, Pa.; J. T. Littleton, Corning Glass Works, Corning, New York; Wm. C. Taylor, Corning Glass Works; E. Ward Tillotson, Assistant Director, Mellon Institute, Pittsburgh, Pa.; W. F. Brown, Libbey-Owens Glass Company, Toledo, Ohio; F. W. Preston, consulting engineer, Butler, Pa.; D. D. Schurtz, Sharp-Schurtz Company, Lancaster, Ohio; A. K. Lyle, chemist, Hazel-Atlas Glass Company, Washington, Pa.; G. E. F. Lundell, U. S. Bureau of Standards, Washington, D. C.; A. Q. Tool, physicist, Bureau of Standards; Herbert Insley, Bureau of Standards; G. E. Merritt, physicist, Bureau of Standards; C. G. Peters, physicist, Bureau of Standards; G. W. Cooper, New York.

• *The above happens to be a report of the first summer meeting of The Glass Division 'way back, ten years ago, in* 1929, *as published in* THE GLASS INDUSTRY *in November of that year. This was the first of the various Division meetings of the A. C. S. to be held—and the men who attended it were pioneers whose example was followed by other groups within the A. C. S. Moreover, these men are still active as leaders in the furtherance of the knowledge of glass.—The Editor.*

Even back in 1929, the technologists could be found hard at work on Chesapeake Bay.

Among those present at that first Glass Division meeting in 1929, as they were ten years ago. From left to right, standing: G. W. Cooper, D. D. Schurtz, Herbert Insley, A. K. Lyle, W. C. Taylor, Wilbur F. Brown, A. Q. Toole, G. E. F. Lundell. Seated: E. Ward Tillotson, Frank W. Preston, J. T. Littleton, Francis C. Flint, C. G. Peters.

METHOD FOR SEALING PLATINUM TO PYREX GLASS

A satisfactory seal between platinum and Pyrex glass, for use in the construction of chemical and other scientific apparatus, has been developed by Edward Wichers and C. P. Saylor, of the Bureau of Standards' Chemistry Division.

The general problem of joining metals and glasses has been studied by many investigators, but the fact that the thermal expansions of platinum and glass are so different has always caused trouble. Thus, when a platinum wire or rod is coated with hot glass, subsequent cooling will crack the glass or pull it loose from the metal. Wichers and Saylor have surmounted this difficulty by using a seamless tube of platinum instead of a wire or rod. If the walls of the tube are thin as compared with its length (say a ratio of 1 to 12), the shrinkage forces are not great enough to crack the glass internally or to pull the metal away from it. In the case of a platinum tube within a glass tube, the relative dimensions of the glass enclosing wall also affect the tension of the boundary. The lower limit for the ratio of diameter to wall-thickness of the glass for this type of seal is set by the resistance of the glass to failure by cracking of the entire wall.

In addition to direct testing for vacuum-tightness, seals made at the Bureau have been examined microscopically to find whether any strains existed, to discover internal cracking, and to locate possible separations of the metal from the glass. The mechanical principles governing the platinum-Pyrex seals can also be applied to other metal-glass seals of the tubular type. From a knowledge of the mechanical and thermal properties of particular glasses and metals, the dimensions of parts of the two materials which are likely to yield satisfactory seals can be calculated. If the cross section of a thin-walled metal tube is insufficient to accomplish a desired purpose, such as the introduction of a given electrical current into an apparatus, a rod with a short tubular jacket welded to it can be used.—News Bulletin of the National Bureau of Standards, July, 1939.

BIBLIOGRAPHY OF LITERATURE ON THE CHEMICAL DURABILITY OF GLASS (1934 to 1939)

• *Five years ago, at Lake Keuka, the Glass Division of the American Ceramic Society held a Symposium on Chemical Durability. At that time* THE GLASS INDUSTRY *contributed to the program by publishing a bibliography of the literature on this subject covering the years* 1900 *to* 1933. *The coming fall meeting of the Glass Division will feature another Symposium on this subject and* THE GLASS INDUSTRY *again offers a contribution to the program by bringing the previous bibliography up to date.*

In the listing below, the title of the article, the author and the original source of the publication is given. .In stead of giving a brief abstract of the paper as before, references are given to the more complete abstracts found in either the "Journal of the American Ceramic Society" or the "Journal of the Society of Glass Technology."
—The Editor

1. *On the Change in Alkali Extractable from Fire-polished Glasses due to Burning Out of the Alkali from the Surface of the Melt.* A. Tielsch and E. Z. Schimmer, Sprechsaal, 66, 285-286, 303-306, 319-322, 334-337, 1933. Abs. J. Soc. Glass Tech., A 307, 1935.

2. *Velocity of Surface Attack on Acid-Soluble Glasses and its Dependence on Thermal History.* E. Berger, Glastech. Ber., 12, 6, 189-98, 1934. Abs. J. Amer. Cer. Soc., A 332, 1936.

3. *Change in the Chemical Properties of Glass Surfaces.* G. Keppeler, Glastech. Ber., 12, 366-372, 1934. Abs. J. Soc. Glass Tech., A 307, 1935. J. Amer. Cer. Soc., A 332, 1936.

4. *Can the Test Proposals for Medicine Glasses According to the D A B* VI, 2, 7, 1931, *be used for Judging a Glass?* T. Grota and F. H. Zschacke. Sprechsaal, 66, 807-808, 1933. Abs. J. Soc. Glass Tech., A 428, 1934.

5. *Glass and Its Chemical Durability.* O. Herfurth. Diamant, 55, 325-327, 337-338, 1933. Abs. J. Soc. Glass Tech., A 333, 1934.

6. *Machine-made Sheet Glass Its Production and Durability.* Diamant, 55, 255-256, 265-266, 277-278, 1934. Abs. J. Soc. Glass Tech., A 308, 1934.

7. *New Researches on the Chemical Durability of Glass.* G. Keppeler. Proc. Inter-Congress Glass and Ceramics, Milan, Sept. 1933. Abs. J. Soc. Glass Tech., A 207, 1934.

8. *Methods of Testing the Chemical Durability of Glass.* A. Granger. Proc. Inter-Congress Glass and Ceramics, Milan, Sept. 1933. Abs. J. Soc. Glass Tech., A 208, 1934.

9. *Water Attack of Lime-Alkali-Silica Glasses.* G. Keppeler and M. Thomas-Welzow. Keram. Rund. 92, 6, 69-71; 7, 81-83; 8, 96-99; 10, 122-24; 11, 136-138; 1934. Abs. J. Amer. Cer. Soc., A 177, 1934.

10. *The Time Factor in Durability Tests.* D. E. Sharp. Symposium on Chemical Durability, Amer. Cer. Soc. Glass Division Meeting, Lake Keuka, Sept. 1934. Abs. Glass Industry, 15, 9, 207, 1934. Ceram. Ind., 23, 4, 214, 1934. Nat. Glass Budget, 50, 21, 14, 1934.

11. *Relation of Electrical Surface Resistance of Glass to Chemical Durability.* E. M. Guyer. Symposium on Chemical Durability, Amer. Cer. Soc. Glass Division Meeting, Lake Keuka, Sept. 1934. Abs. Glass Industry, 15, 9, 210, 1934. Ceram. Ind., 23, 4, 212, 1934. Nat. Glass Budget, 50, 23, 16, 1934.

12. *Flat Glass.* W. F. Brown. Symposium on Chemical Durability, Glass Division American Ceramic Society Meeting, Lake Keuka, Sept. 1934. Abs. Glass Industry, 15, 9, 205, 1934. Ceram. Ind., 23, 4, 187, 1934. Nat. Glass Budget, 50, 21, 14, 1934.

13. *Glass Containers.* F. C. Flint. Symposium on Chemical Durability, American Ceramic Society, Glass Division Meeting, Lake Keuka, Sept. 1934. Abs. Glass Industry, 15, 9, 205, 1934. Ceram. Ind., 23, 4, 187-188, 1934. Nat. Glass Budget, 50, 23, 16, 1934.

14. *The Corrosion of Glass as a Problem in Its Manufacture, Distribution and Service.* W. C. Taylor. Symposium on Chemical Durability, Amer. Cer. Soc. Glass Division Meeting, Lake Keuka, Sept., 1934. Abs. Glass Industry, 15, 9, 205, 1934. Ceram. Ind., 23, 4, 188, 1934. Nat. Glass Budget, 50, 21, 14, 1934.

15. *Chemical Durability of Glass and Methods for Its Measurement.* G. W. Morey. Symposium on Chemical Durability, Amer. Cer. Soc. Glass Division Meeting, Lake Keuka, Sept., 1934. Abs. Glass Industry, 15, 9, 206, 1934. Ceram. Ind., 23, 4, 214, 1934. Nat. Glass Budget, 50, 21, 14, 1934.

16. *The Measurement of Chemical Durability of Flat Glass.* J. S. Gregorius. Symposium on Chemical Durability, Amer. Soc. Glass Division Meeting, Lake Keuka, Sept., 1934. Abs. Glass Industry, 15, 9, 209, 1934. Ceram. Ind., 23, 4, 188-91, 1934. Nat. Glass Budget, 50, 21, 14, 1934.

17. *Methods of Determining Special Types of Chemical Durability.* M. E. Nordberg. Symposium on Chemical Durability, Amer. Cer. Soc. Glass Division Meeting, Lake Keuka, Sept., 1934. Abs. Glass Industry, 15, 9, 209, 1934. Ceram. Ind., 23, 4, 191, 1934. Abs. Nat. Glass Budget, 50, 21, 15, 1934.

18. *On Chemical Durability.* J. Bailey, Glass Industry, 15, 171, 1934. Abs. J. S. Glass Tech., A 428, 1934. J. Amer. Cer. Soc., A 289, 1934.

19. *Chemical Durability of Containers.* A. K. Lyle. Glass Industry, 15, 147-148, 1934. Abs. J. Soc. Glass Tech., A 333, 1934. J. Amer. Cer. Soc., A 252, 1934.

20. *Pharmaceutical Containers and Their Durability.* W. R. Lester. Glass Industry, 15, 139-140, 1934. Abs. J. Soc. Glass Tech., A 334, 1934. J. Amer. Cer. Soc., A 255, 1934.

21. *Chemical Durability of Glass, Committee Progress Report.* Anon. Bull. Amer. Cer. Soc., 13, 11, 319-20, 1934.

22. *Corrosion of Glass Bottles by Alcoholic Solutions.* V. Dimbleby. Glass Rev., 10, 9, 134-37, 1934. Abs. J. Amer. Cer. Soc. A 33, 1935.

23. *Batch Constituents and Their Effect on Durability of Glass.* D. B. Burress. 2nd Conference on Glass Problems, Nov., 1934, Univ. of Ill. Urbana. Abs. Glass Ind., 15, 11, 276, 1934. Ceram. Ind., 23, 6, 310-13, 1934.

24. *Important Properties of Bottle Glass.* G. Keppeler and F. Korner. Sprechsaal, 67, 40, 607-609, 41, 623-27, 42, 640-42, 1934. Abs. J. Amer. Cer. Soc., A 66, 1935.

25. *Packing and Storing Glass Panes.* G. Killian. Fachausscherssber. Deut. Glastech Ges. No. 28, Feb., 1934. Abs. J. Amer. Cer. Soc., A 66, 1935.

26. *The Influence of Boric Oxide on the Rate of Melting and on the Thermal Expansion and Resistance to Weathering of Soda-Lime-Silica Sheet Glasses.* V. Dimbleby, M. Parkin E. Seddon, W. E. S. Turner and F. Winks. J. Soc. Glass Tech., 18, 69, 13, 1934. Abs. J. Amer. Cer. Soc., A 233,1934.

27. *Free Alkali in Glass.* L. F. Gabel. J. Amer. Pharm. Assn., 23, 1174-1177, 1934. Abs. J. Soc. Glass Tech., A 406, 1935. J. Amer. Cer. Soc., A 212, 1935.

28. *The Basis of a Standard Test for the Chemical Durability of Glass Bottles.* W. E. S. Turner, H. S. Blackmore, V. Dimbleby, H. S. Y. Gill, H. W. Howes, and W. J. A. Warren. J. Soc. Glass Tech., 19, 74, 171, 1935.

29. *Note on the Effect of Zirconia on the Chemical Durability of Some Borosilicate Glasses.* W. Horak and D. E. Sharp. J. Amer. Chem. Soc., 18, 281-282, 1935. Abs. J. Soc. Glass Tech., A 216, 1936.

30. *The Electrodialysis of Some Enamels and Glasses.* R. M. King. J. Amer. Cer. Soc., 18, 230-233, 1935. Abs. J. Soc. Glass Tech., A 216, 1936.

31. *Time Law of Extraction of Glasses.* E. Berger and W. Geffeken. Naturwissenschaften, 23, 817-18, 1935. Abs. J. Amer. Cer. Soc., A66, 1938.

32. *Weathering and Corrosion of Glass by Water, Acids and Alkalies.* V. Dimbleby. Foundry Trades Jour., 52, 978, 325-27, 1935. Abs. J. Amer. Cer. Soc., A 299, 1936.

33. *Some Effects of Storage on the Chemical Durability of Glass Containers.* V. Dimbleby, H. S. Y. Gill and W. E. S. Turner. J. Soc. Glass Tech. 19,75, 231, 1935. Abs. J. Amer. Cer. Soc., A 58, 1936.

34. *Observations on the Action of Steam on Glass.* O. G. Burch. J. Amer. Cer. Soc., 18, 233-238, 1935. Abs. J. Soc. Glass Tech., A 63, 1936.

35. *Chemical Durability of Glass; Results of Tentative Test Method. Committee on Chemical Durability of Glass.* Bull. Amer. Ceram. Soc., 14, 5, 180-84, 1935.

36. *The Testing of Glass Containers for Chemical Durability.* W. E. S. Turner. Jour. Amer. Cer. Soc., 18, 135-141, 1935. Abs. Glass Industry, 15, 9, 210, 1934. J. Soc. Glass Tech., A 214, 1935.

37. *The Chemical Durability of Glass; A Plea for a Standard Method of Test.* W. E. S. Turner. Bull. Amer. Cer. Soc., 14, 165-169, 1935. Abs. Glass Industry, 15, 9, 210, 1934. J. Soc. Glass Tech., A 308, 1935.

38. *The Effect of Alumina upon the Chemical Durability of Sand-Soda-Lime Glasses.* A. K. Lyle, W. Horak and D. E. Sharp. J. Amer. Cer. Soc., 19, 142, 147, 1936. Abs. J. Soc. Glass Tech. A 128, 1937.

39. *The Methods of Testing Laboratory Glassware.* J. Herbert. International Congress on Glass, London-Sheffield, July 1936. Abs. J. Soc. Glass Tech., A 299, 1936.

40. *The Grain Test for Determining the Chemical Corrosion of Glass.* W. E. S. Turner. International Congress on Glass, London-Sheffield, July 1936. Abs. J. Soc. Glass Tech., A 298, 1936.

41. *A Critical Examination of the Standard Test for the Chemical Durability of Glass Bottles.* A. Cousen. J. Soc. Glass Tech., 20, 81, 418, 1936. Abs. J. Soc. Glass Tech., A 299, 1936.

42. *A Note on the Powder Method of Comparing the Solubilities of Glasses.* A. R. Wood. J. Soc. Glass Tech., 20, 81, 416, 1936. Abs. J. Soc. Glass Tech., A 298, 1936.

43. *Solubility Characteristics of Glasses Basically Different in Composition.* W. C. Taylor and R. D. Smith. J. Amer. Cer. Soc., 19, 11, 331-335, 1936.

44. *Methods for Determining the Chemical Durability of Soda-Lime Glasses.* O. G. Burch. Bull. Amer. Ceram. Soc., 15, 175-181, 1936. Abs. Glass Industry, 15, 9, 209, 1934. J. Soc. Glass Tech., A 127, 1937.

45. *The Problem of Determining the Magnitude of the Surface Area of Glass Grains.* E. Berger and W. Geffeken. Glastech. Ber., 14, 441, 1936. Abs. J. Soc. Glass Tech., A 352, 1937. J. Amer. Cer. Soc., A 17, 1939.

46. *The Effect of Boric Oxide and Zinc Oxide as Constituents of Glasses.* J. Enss. Glastech. Ber., 14, 279-281, 1936. Abs. J. Soc. Glass Tech., A 129, 1937.

47. *Durability of Soda-Lime-Magnesia Glasses.* K. Tabata, T. Yokoyama and T. Kobayashi. J. Jap. Ceram. Assn., 43, 801, 1936. Abs. J. Soc. Glass Tech., A 63, 1936. J. Amer. Cer. Soc., A 60, 1938.

48. *A Report of Progress on Glass Durability Methods.* W. C. Taylor. J. Soc. Glass Tech., 20, 81, 405, 1936. Abs. J. Soc. Glass Tech., A 299, 1936. J. Amer. Cer. Soc., A 14, 1938.

49. *Fundamental Principles Underlying the Corrosion of Glass.* E. Berger. International Congress on Glass, London-Sheffield, July 1936. Verre Sil. Ind., 8, 185-187, 198-200, 209-214, 1937. J. Soc. Glass Tech., 20, 80, 257, 1936. Abs. J. Soc. Glass Tech., A 298, 1936. J. Amer. Cer. Soc., A 13, 1938.

50. *The Crushing and Sieving of Glass to Ensure Control of the Surface of the Grains.* E. Berger. J. Soc. Glass Tech., 20, 81, 384, 1936. Abs. J. Soc. Glass Tech., A 298, 1936. J. Amer. Cer. Soc., A 11, 1938.

51. *The Chemical Composition of Glasses Suitable for*

the Manufacture of Window Glass by the Automatic Drawing Process. K. Kamita, H. Yamamoto, M. Matsuo, H. Yagai and H. Ota. J. Soc. Glass Tech., 20, 80, 170, 1936. Abs. J. Amer. Cer. Soc., A 11, 1938.

52. *Determination of the Durability of Glass.* A. Cornille. Ceram. Ver. Email, 4, 11-15, 1936. Abs. J. Soc. Glass Tech., A 279, 1937. J. Amer. Cer. Soc., A 239, 1937.

53. *Durability of Colored Glasses.* K. Nakanishi. J. Jap. Ceram. Assn., 44, 518, 85-90, 1936. Abs. J. Amer. Cer. Soc., A 86, 1937.

54. *Studies on Chemical Compositions and Water Solubilities of Glasses.* I. S. Nagai and N. Mikami. J. Jap. Ceram. Assn., 42, 399, 1934. Abs. J. Soc. Glass Tech., A 427, 1934. II., S. Nagai and Y. Kato. J. Jap. Ceram. Assn., 43, 719-721, 1935. Abs. J. Soc. Glass Tech., A 64, 1936. III., S. Nagi and K. Takahasi. J. Jap. Ceram. Assn., 44, 143-145, 1936. Abs. J. Soc. Glass Tech., A 216, 1936. J. Amer. Cer. Soc., A 85, 1937. V., S. Nagai and S. Nagaeda. J. Jap. Ceram. Assn., 45, 299-312, 1937. Abs. J. Soc. Glass Tech., A 353, 1937. VI., S. Nagai and S. Nagaeda. J. Jap. Ceram. Assn., 45, 536, 523-34, 1937. Abs. J. Amer. Cer. Soc., A 70, 1939. VII., S. Nagai and S. Nagaeda, J. Jap. Ceram. Assn., 45, 693-706, 1937. Abs. J. Soc. Glass Tech., A 59, 1938.

55. *Easy Methods of Testing Glasses for their Resistance to Weathering.* F. Stein. Glashütte, 67, 130, 1937. Glass Industry, 18, 124, 1937. Abs. J. Soc. Glass Tech., A 204, 1937.

56. *The Testing of Glass Ampoules.* O. Knapp. Keram. Rundschau, 45, 589, 600, 1937. Abs. J. Soc. Glass Tech., A 127, 1938.

57. *The Resistance of Glasses to Acids and Alkalies.* K. Tabata, T. Yokoyama and T. Kusama. J. Jap. Ceram. Assn., 45, 897-905, 1937. Abs. J. Soc. Glass Tech., A 127, 1938. J. Amer. Cer. Soc., A 72, 1939.

58. *Some Studies on Reactions Between Glasses and Phosphate Solutions.* J. B. Brown and A. S. Watts. J. Amer. Cer. Soc., 20, 245-250, 1937. Abs. J. Soc. Glass Tech., A 422, 1937.

59. *The Composition and Properties of the Chief Types of Commercial Glasses.* G. Keppeler. J. Soc. Glass Tech., 21, 88, 415-427, 1937. Abs. J. Amer. Cer. Soc., A 247, 1938.

60. *Chemical Strength of Glass in Dependence on Thermal Treatment.* O. S. Molchanova. Optico-Mekh. Prom., 7, 8, 3-5, 1937. Abs. J. Amer. Cer. Soc., A 247, 1938.

61. *Chemical Resistance of Glass and Methods of Testing.* W. Tepohl. Glashütte, 67, 525, 1937. Abs. J. Soc. Glass Tech., A 58, 1938. J. Amer. Cer. Soc., A 214, 1938.

62. *Tests Disprove Theory that Glassware Bloom Is Caused by Dust from Fibre Containers.* G. R. McDaniel. Nat. Glass Budget, 53, No. 8, 4, 1937. Abs. J. Soc. Glass Tech., A 279, 1937. J. Amer. Cer. Soc., A 101, 1938.

63. *Attempts to Determine Chemical Resistance of Glass According to the Method of Radioactive Indicators.* V. G. Voano. Optiko-Mekh., 7, 4, 16-17, 1937. Abs. J. Amer. Cer. Soc., A 60, 1938.

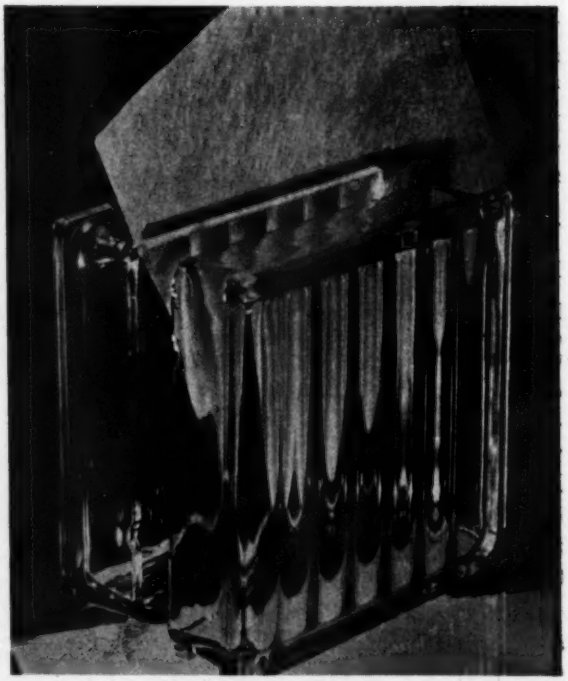
64. *Chemical Stability of Fourcault Window Glass.* N. I. Samsonov. Keram. and Steklo, 14, 4, 32-34, 1938. Abs. J. Amer. Cer. Soc., A 15, 1939.

65. *Chemical Stability of Glasses II.* W. Geffeken and E. Berger. Glastech. Ber., 16, 9, 296-304, 1938. Abs. J. Amer. Cer. Soc., A 45, 1939.

66. *The Base Release of Some Commercial Glasses as Determined by Electrodialysis.* R. M. King. J. Amer. Cer. Soc., 22, 1, 1-8, 1939.

DEVELOPS NEW GLASS BLOCK

The Pittsburgh Corning Corporation has developed a new glass building block which contains an interior screen of glass fiber that sharply reduces the transmission of solar energy, and gives a soft diffused light that reduces glare of the sun. The decreased solar heat transfer also cuts down the cooling load in air-conditioned rooms. The fiberglas sheet is sealed between the blocked halves, forming an integral part of the finished unit in the center of the block; the high sealing temperature results in the formation of a partial vacuum in the block interior when it cools, which increases the insulating value of the unit. Variations in the effect desired may be obtained by changing the thickness of the fiberglas sheet. A typical unit of this new block transmits 55 per cent as much energy as the older block and 75 per cent as much light with a marked increase in light diffusion.



Illustrating the method of assembly of the new Pittsburgh Corning block in which the fiberglas screen is sealed between two halves into an all-glass welded unit.

REBUILT FORD MOTOR LEHR FIRED WITH COKE-OVEN GAS

Plate-glass annealing lehr at the River Rouge plant of the Ford Motor Co., originally heated by electricity, now utilizes coke-oven gas in special burners with notable results in maintenance of desired temperature gradient and economy.

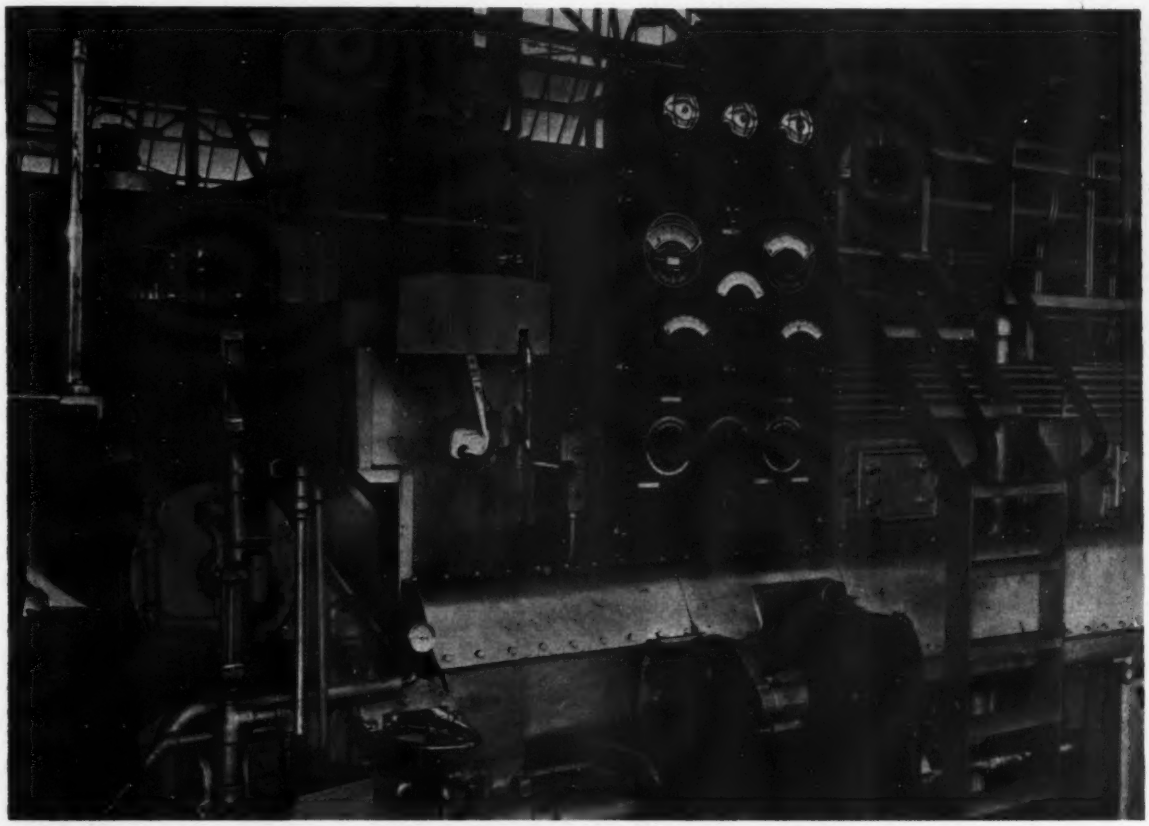


Fig. 1. This view in the River Rouge glass plant of the Ford Motor Co. shows the plate glass rolling machine at the left and the front end of the lehr tunnel at the right. The control panel for the lehr drive and the end of the catwalk above the lehr can also be seen.

One of the few large-scale applications of electrical heating in the glass industry has been the plate-glass annealing lehr at the River Rouge glass plant of the Ford Motor Co., in Dearborn. The construction and operation of this lehr was illustrated and described in the January, 1938, issue of THE GLASS INDUSTRY and its operation has been reasonably successful over a period of years. But Ford engineers set high standards for equipment operation and it was decided early this year to change the lehr over to coke-oven gas, in an attempt to lower annealing costs and improve the efficiency of the annealing operation.

The rebuilding operation was completed a few months ago and subsequent operation shows that the objectives of lower costs and improved annealing have been reached. The construction work included replacement of the electrical heating elements with gas heating units of the new Firoll type; repair of the lehr housing; replacement of the first 100 glass-carrying rollers with a special alloy type; and a change in the ventilating system. The redesign and reconstruction of the lehr was in charge of The Toledo Engineering Company.

In the Ford continuous rolling machine a sheet 51½ in. wide and 0.170 in. thick is produced and passes directly into the lehr, as shown in Fig. 1. The average operating speed of the lehr is about 150 in. per min., some 20 per cent greater than the speed of the rolling machine, and the sheet tends to stretch as it passes into the lehr. As a result the annealed sheet is discharged from the lehr with a width of about 50 in. and it is finally trimmed to a width of 46 in., cut into 140-in. lengths, and delivered to the grinding and polishing department. During normal operation about 83 tons of rough-rolled sheet passes through the lehr every 24 hours.

As shown in the accompanying longitudinal section of the rebuilt lehr, Fig. 2, the length of the enclosed tunnel

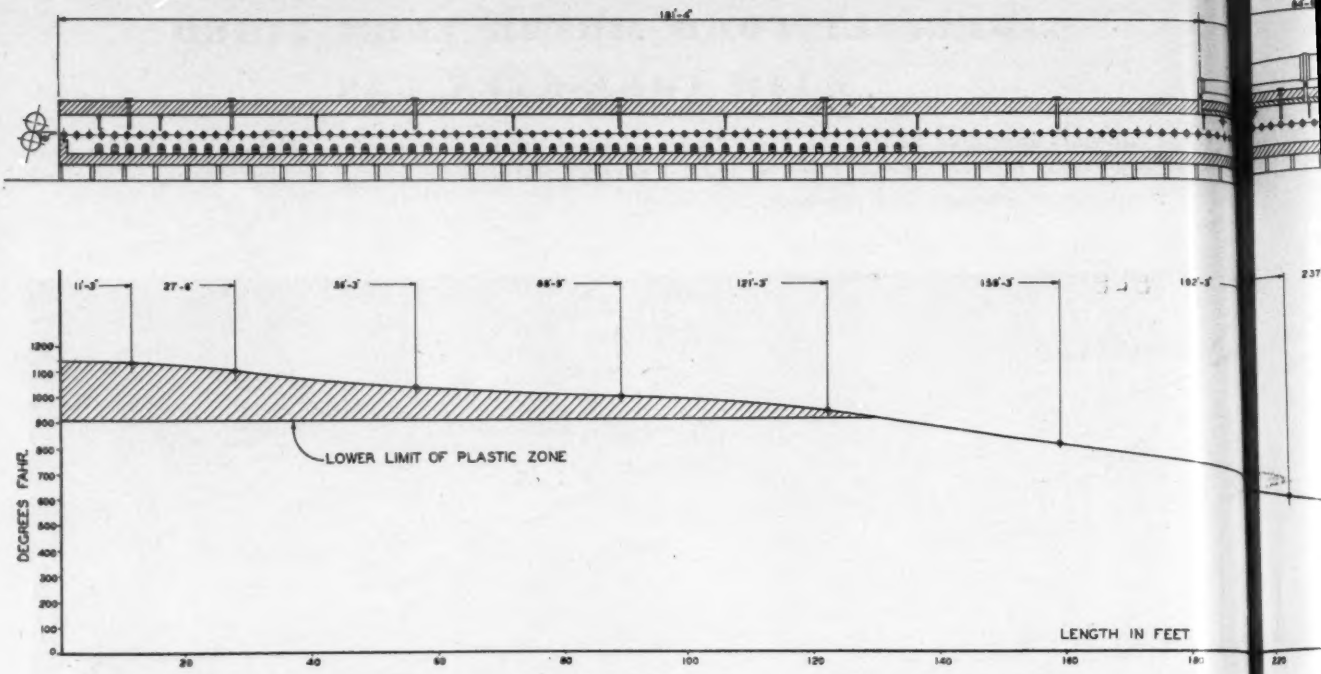


Fig. 2. Longitudinal section through rebuilt Ford Motor Co. lehr. At extreme left sheet passes from rolling machine into heated section of lehr in which it is carried by power-driven rollers above 53 Firoll heating units. At the right are the cooling ducts, flue and stack. Small partitions divide the tunnel into zones, each zone being provided with a thermocouple near the center. Temperature gradient curve below shows the temperature in each zone and the distances from the front end of the lehr to each thermocouple.

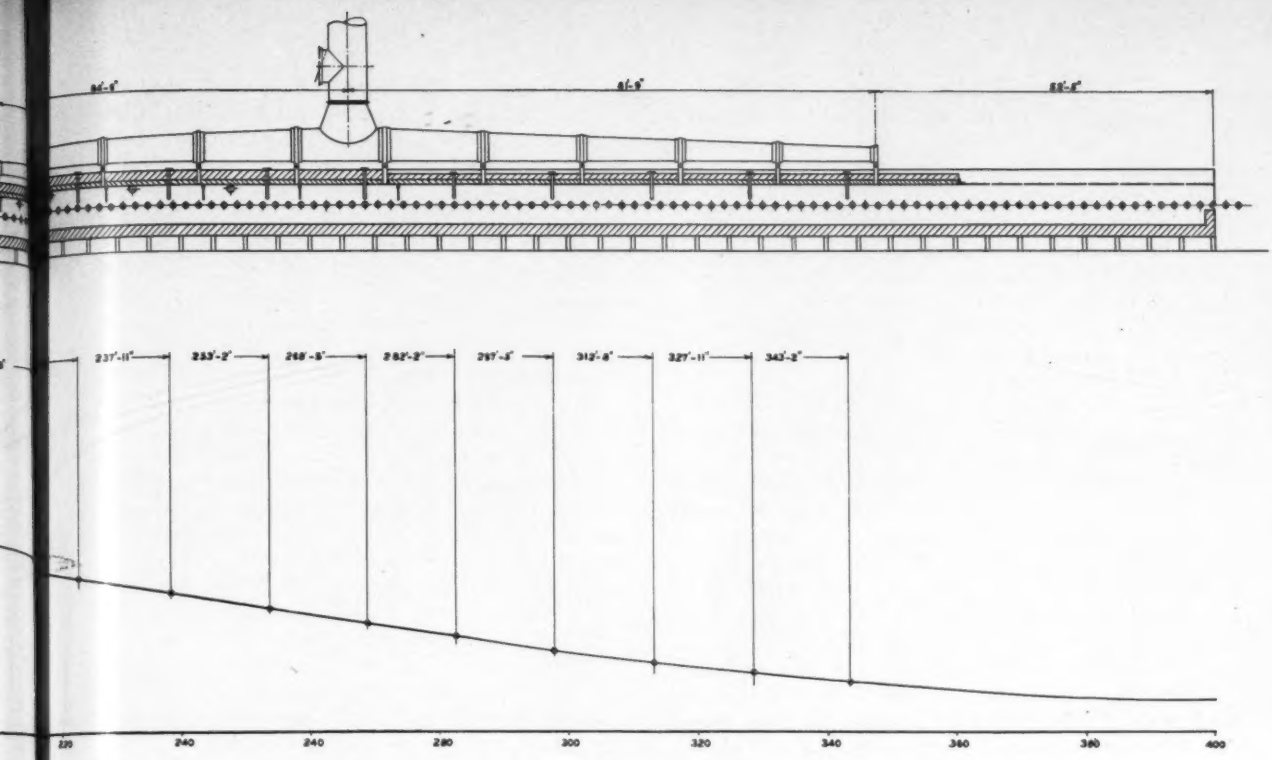
is 400 ft. and this is followed by a 75-ft. open section, all sections being 58 in. wide, inside. The heated section of the tunnel is 132 ft. long. Here the glass strains are relieved and the sheet is then subjected to controlled cooling in the remaining 168-ft. length of the tunnel. The lehr housing is built of ¼-in. steel plate, lined with 9 inches of insulation brick in the side walls. The top of the lehr incorporates 4-in. refractory tile and 9 inches of insulation in the heating zone, the thickness of the insulation decreasing gradually tward the discharge end of the lehr. Clean-out doors are located in both side-walls of the lehr below the level of the glass-carrying rollers and are spaced about 5 ft. apart. Inspection doors located above the rollers at the entrance end are used to facilitate starting the sheet through the lehr.

Starting near the entrance end of the lehr, 53 heating units of the Firoll type are spaced every 30 in. on the floor of the tunnel below the glass-carrying rollers. In the usual belt or pan type of lehr the Firoll tubes are mounted on trunnions and rotate as the belt passes over them, but in this case the tubes are mounted in a stationary position, as shown in Figs. 2 and 3. The tubes are made of heat-resisting alloy and are 6 in. in diameter. Each Firoll heating unit includes a gas burner, a combustion tube and a draft induction pipe, these parts being clearly shown from left to right in Fig. 3. The burners for adjacent tubes are located on opposite sides of the lehr. For instance, if the first tube is fired from the left, the second will be fired from the right, the third from the left, and so on, this arrangement giving an excellent uniformity of heat across the tunnel. The heating section of the lehr is divided into several zones, in each of which the temperature is controlled through automatic adjustment of the group of burners in that zone, as will be explained in detail later.

From the zone fuel header the coke-oven gas passes through a solenoid shut-off valve and a hand-operated valve before entering the burner. Each burner consumes an average of 50 to 60 cu. ft. of 490 Btu. coke-oven gas per hour, the total fuel consumption for the entire lehr averaging 2,728 cu. ft. of gas per hour. From the burner the combustion products pass into the open-end 6-in., alloy Firoll combustion tube, in the other end of which is located the draft induction pipe. Draft is induced by a jet of low-pressure compressed air from a pipe located alongside the lehr and the amount of air can be regulated by a valve in the inlet pipe.

Regulation of the induced draft is an important feature of the Firoll heating unit. Since each end of the combustion tube is open, proper regulation of the induction air produces a slight positive pressure in the tube, causing a spillage of hot combustion products at the discharge end of the tube. These hot gases pass up the side walls, thus maintaining the proper annealing temperature clear to the extreme edges of the sheet and at the same time producing a slight positive pressure in the lehr tunnel. The air for the draft induction tubes is furnished by a fan which is driven by a 2-hp. motor. The smaller of the two fans shown in Fig. 4 supplies this air.

As stated previously, the heated section of the lehr tunnel is divided into five zones, each of which is furnished with a thermocouple and separated from adjacent zones by suitable partitions. In Fig. 2 the thermocouple tubes can be seen passing through the roof of the tunnel near the center of each zone and the distance of each



thermocouple from the entrance end of the lehr is shown on the temperature gradient chart. The small partitions between the zones are also shown. The distribution of burners in the various zones is as follows: Zone 1, 4 burners; zones 2, 10 burners; zone 3, 13 burners; zone 4, 13 burners; zone 5, 13 burners. The temperature in each zone is maintained at the desired point by automatic regulation of the group of burners in that particular zone.

The flow of fuel gas and induction air to each group of heating units is regulated by a motor-operated dual valve in the fuel and air lines to the burner group, the valve being shown in Fig. 5. This valve controls the amount of gas passing to the burners and also the amount of air passing to the draft induction tubes of the burner group, so that the ratio of induced draft to burner output remains constant. The operation of the dual-valve motor is controlled by the zone thermocouple through a potentiometer-type control instrument. It is interesting to note that the theoretical temperature gradient, shown in Fig. 2, has actually been maintained continuously and without difficulty since the beginning of operations.

As stated previously, the first 100 glass-carrying rolls in the Ford lehr were replaced with new rolls of alloy steel, these rolls having an outside diameter of 6 in. and a wall thickness of $\frac{3}{8}$ in. As shown in Fig. 3, each roll is mounted in bearings outside the lehr tunnel and is driven by a gear which meshes with a worm on a long shaft running longitudinally alongside the lehr. At each end of each roll, where it passes through the side wall, is provided a radiation disk which serves to insulate the heated portion of the roll inside the tunnel from those portions mounted in the outside bearings. Since the installation of the new rolls it has been noted that the bearing temperature is 50 deg. F. lower than formerly. The first 26 rolls are spaced 10 in. on centers;

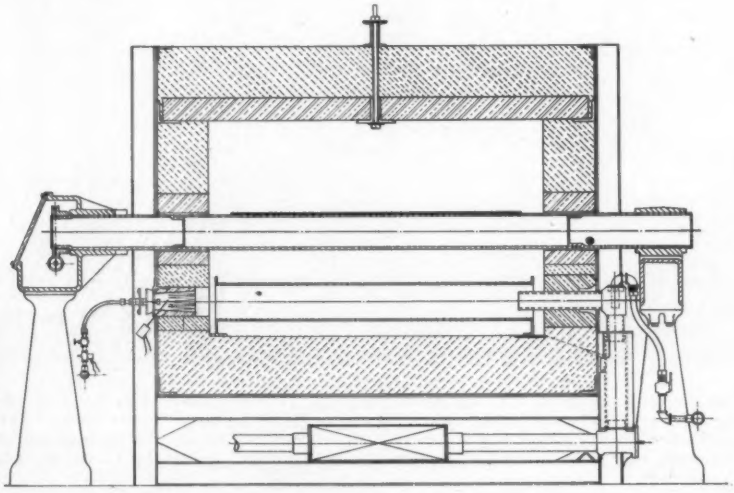


Fig. 3. Cross section through a Firoll heating unit in the heated section of the rebuilt Ford lehr. The coke-oven gas burner at the left fires into the alloy combustion tube. Combustion products are withdrawn by the draft inductor at the right and delivered to the longitudinal flue below the tunnel. Each glass-carrying roller has two radiation disks and is driven by a worm gear.

the next four are 12 in. apart; the following 15 have a 15-in. spacing; and all the remaining rolls are on 20-in. centers. The long worm shaft is driven by a 40-hp., direct-current motor which also drives the rolling machine.

The ventilation system of the rebuilt lehr performs two important functions: first, to exhaust the burned gases from the Firoll heating units and, second, to exhaust the products of combustion and hot air from the cooling zone of the lehr tunnel. From each heating unit the exhaust pipe of the induced draft tube leads into a long rectangular flue located beneath the floor of the tunnel and running the entire length of the heated section. Midway of the length of the flue an outlet pipe leads to the inlet of a low-pressure exhaust fan, shown in Fig. 4, which in turn discharges the contents of the flue to a point outside the building. This fan is driven by a 2-hp. motor.

Ventilation of the cooling end of the lehr is accomplished by means of ducts leading from the tunnel into a long flue, the flue being connected in turn to a stack. The arrangement is clearly shown at the right in Fig. 2 and in Fig. 6. In the former construction the flue extended only from the stack to the cold end of the lehr and the ducts were not provided with dampers, the idea being that the stack draft would cause an influx of cold air at the discharge end of the tunnel to hasten the cooling at this point and that a dead-air space would be maintained in the electrically heated portion of the tunnel. Actually air was drawn in at the front end of the lehr and passed down through the heated zone to the ducts and out at the stack.

All of the ducts leading to the new flue are provided with dampers and air is still drawn in at the discharge end of the tunnel. The ingress of air at the lehr entrance has, however, been eliminated by virtue of the spillage of hot combustion products into the tunnel from each Firoll heating unit. This spillage produces a slight positive pressure in the heated zone with the result that a small portion of the combustion products passes out at the front end of the lehr past the damper, the remainder passing through the heating section into the ducts leading to the ventilation flue. The combination of all these factors permits accurate regulation of the temperature gradient in all parts of the lehr and its continuous maintenance within very close limits under all conditions.

At the Ford Motor Co. extreme precautions are always taken to insure, as far as possible, absolute safety in the use of gas-burning equipment and this policy has been followed in the automatic safety devices provided for the rebuilt lehr. One of these devices automatically closes the gas valve for any group of burners in case either the fuel supply or the draft induction air supply is interrupted; the other automatically closes the valve in the fuel line to any individual burner in case the flame in that particular burner goes out.

The gas-air safety mechanism has two diaphragms, one of which is acted upon by the pressure in the gas line to the burner group and the other by the pressure of the induction air in the line leading from the fan. Should the pressure fail in either line, the action of the diaphragms automatically causes a safety valve in the fuel line to close and this valve must be reset by hand before the gas can again enter the burners. The flame-actuated control is provided for each of the 53 burners and includes a hot-wire device connected to a solenoid valve, the location of these parts in relation to the burner being shown in Fig. 3. The tip of the wire is in the path

Fig. 4. Ventilation fans located on top of lehr casing. The smaller fan at the left supplies draft induction air to the Firoll heating unit. The larger fan exhausts burner combustion products from the flue beneath the tunnel. Note also the flame control signal lights at upper left.

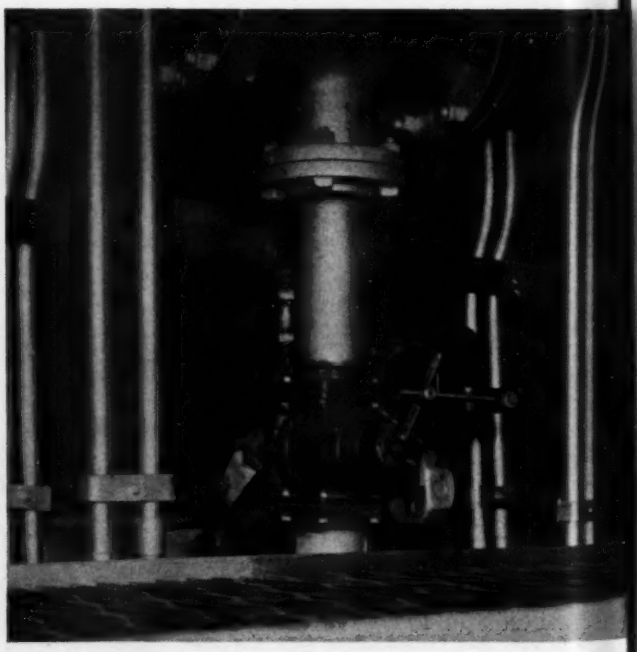


Fig. 5. One of the motor-operated dual valves which automatically control the amount of fuel gas and induction air supplied to each group of Firoll heating units. These valves are actuated by thermocouples in each zone.

Fig. 6. View near the discharge end of the Ford lehr showing the ventilation flue and stack.

Fig. 7. To the left of the catwalk above the heating zone of the lehr are located the motor-operated dual valves, together with the flame control boxes and signal lights.

of the flame and the electrical circuit formed through the flame causes the solenoid valve in the fuel line to remain open. Should the flame be interrupted for any reason, however, the electrical circuit is automatically broken and the solenoid valve immediately closes, shutting off the supply of fuel to the burner. The flame control is also connected to a system of signal lights located on top of the lehr and shown in Figs. 4 and 7. While any burner is operating properly its accompanying red light appears on top of the lehr, but the absence of any one light indicates that its particular burner is not functioning properly.

It can be seen from the foregoing that the rebuilding of the Ford lehr for the use of coke-oven gas has provided a smooth-running, economical mechanism and, better yet, an improvement in the annealing results has also been shown by a decrease of breakage within the lehr, less indication of strain under the polariscope and greater resistance to breakage under the drop test. Since the redesign, breaks of the sheet while passing through the lehr have been practically eliminated. The sheet is so well annealed that no breakage results from stones unless they are exceptionally large and small stones are not even cut out of the sheet before grinding. Stones of medium size which protrude above the surface of the sheet are dressed down with a portable grinder before the sheet is placed on the grinding table.

Samples of annealed sheet taken from this lehr before rebuilding usually showed a considerable amount of strain, these strains appearing as lines running longitudinally through the sample. Present samples show practically complete elimination of strain lines in the annealed sheet.

Freedom from strain after annealing is also confirmed by drop tests. In these tests a one-ounce steel ball is dropped from varying heights upon an annealed sample 12 inches square, the height from which the ball must be dropped to cause breakage being a measure of the strength of the sheet. Two samples from the same portion of the sheet are used in each test, one sample being tested with the same side up as when it passed through the lehr and the other sample bottom side up. Formerly the samples showed a wide difference in the strength of the top and bottom faces of the samples, the face of the glass which came in contact with the lehr rollers usually shattering under a 24-in. impact, while the top face fould withstand a drop of 60 inches. It should be remembered that each drop test measures the strength of the under side of the sample, opposite to the face which the ball strikes. It was recognized that the lower face of the sheet discharged from the old lehr was harder and carried a greater amount of strain, so an automatic device was installed to turn the sheet over and bring the hard side into contact with the grinding and polishing heads first.

Samples of glass from the rebuilt, gas-fired lehr withstand the impact of a 60-in. drop on both faces, with a variation of breaking strength between the two faces not to exceed 20 per cent. A sheet that will withstand a 60-in. impact is considered satisfactory for service and the use of the automatic turn-over mechanism is no longer necessary.

STEVENSON CORPORATION INDICTED

A Federal grand jury has indicted the Stevenson Corporation, operator of Stevenson, Jordan & Harrison, alleging stifling of competition in violation of the Sherman anti-trust act. Stevenson, Jordan & Harrison is a business engineering concern managing a number of trade associations, among them the Glass Container Association and the American Glassware Association.

ON GAS PRODUCERS

Les Gazogènes, by H. Guillon, Chaleur et Industrie, Paris, pp. 126, *Paper covers,* 30 *frs.*

Since most of the peoples of the earth who need heat must use solid fuels, and since many industrial operations can only be carried on with gaseous fuel at the actual scene of combustion, the problem of converting solid fuel into gaseous is a fundamental preoccupation. The conversion is the function of gas-producers.

These last are, as a rule, uncomfortable, contankerous, smelly, hot, and ill-behaved contraptions of immense size and weight, and run in a haphazard and empirical manner. Fortunately, one or two of our outstanding glass technologists began life as gas-works technologists or producer specialists, but by most the underlying principles are neglected, and by many they are not even understood. Even our textbooks are not as explicit as they might be.

This little French review is, within its short compass, as good a digest of the whole matter as we have seen. It is also entertainingly written. We quote a few paragraphs from the last chapter of the book.

"The progress of the Producer has been hindered by a lack of collaboration between scientists and technicians: remarkable laboratory work has been badly interpreted and generalized. Then workshop technique has taken possession of this field, and has expected to be able, single-handed, to cope with all the difficulties reported in the factory, by means of mechanical improvements. The result has been admirable machines, but too costly, and with an output which has not been improved, rather the contrary: in addition to which they stick on mechanical stokers: to burn five tons of coal an hour you are offered sixty tons of assembled metal parts: it is the triumph of German industry. The whole thing is studied down to the smallest detail. Each operation is carried out by a mechanical contrivance: if the contrivance has once failed, it has been replaced by another ten times heavier and more robust: there is a risk of over-heating, heat resistant steel is provided, or a water-jacket—an excellent device for wasting heat. An apparatus is arrived at, which answers all objections, and which stands up perfectly, but which, looked at from a detached position, appears to be a paradoxical solution: and one is instinctively repelled by the cumbersomeness of the thing.

"It is necessary to seek elsewhere, and in our time of mechanical improvements deliberately to force oneself not to resort to this kind of solution except for indispensable operations and those for which a man's strength is insufficient.

"We saw some time ago a curious and instructive example: in a forest of the West, the last gentleman glassblower of France keeps a glass plant heated by wood; outside normal industrial competition, the factory has retained unchanged the ancient order of things, to the point that on the furnace constructed of materials quarried and fired in situ, they fix, on starting up, the old cross of wrought iron and the blest bough, for one is never sure of one's luck, even in following to the letter the methods of the ancients. The hearth which feeds this furnace is a kind of Gas Producer, and of *perfect* functioning, since it guarantees with wood from the thicket as combustible material, and without regeneration of the air, a temperature sufficient for melting the glass, and it has been prepared so as to assure this operation without the possibility of getting out of order, with a staff who have no idea, from the highest to the lowest of the hierarchy, what a rational order is. In this hearth, conceived in an epoch when iron was reserved for iron foundries, there is not a mechanical part, not even a gramme of metal. Contemplating with the joy of a specialist the diverse characteristics—how simple they are—of this hearth, and interpreting them with our engineering language, we saluted with admiration the memory of the man who, several centuries ago, without scientic knowledge, but by means of intelligence and observation, produced this furnace.

"And we thought that if this man now had coal to gassify, he would produce something else than a machine: it is evidently only a question of applying the methods of research."

"Under the inspiration of American methods, and impressed by the difficulty of recruiting operators, we have sought a machine which we could entrust to a mechanic. Much might be said on this point, but it is not our subject. We only point out that we have been struck too often by the professional quality of the French workman, who, in spite of all the existing difficulties, persists in wanting to work intelligently, not to regret this American tendency which cuts off our industry from its natural advantages; one can make the work easier for the artisan, render it less onerous for him, without ceasing to appeal to his intelligence and to his professional worth."—F. W. P.

PRODUCTION FIGURES FOR THE GLASS INDUSTRY DURING JULY, 1939

Plate Glass: The total production of polished plate glass by member companies of the Plate Glass Manufacturers of America during July, 1939, was 6,212,209 sq. ft., as compared to 9,288,788 sq. ft. produced in the preceding month, June, 1939, and 5,505,768 sq. ft. produced in July, 1938.

Window Glass: During July, 1939, the production of window glass was 690,418 boxes, which represents 42.6 per cent of industry capacity. As compared with this, July, 1938, production was 330,223 boxes, representing 20.3 per cent of industry capacity.

Glass Containers: Production of glass containers during July, 1939, was 4,581,594 gross, bringing the 1939 total to 28,917,347 gross. Shipments during July were 4,136,097 gross, bringing the 1939 total to 27,928,470 gross.

WINS PATENT SUIT

The Solar Laboratories, Beaver, Pa., reports that they have received a favorable decision in their suit against the Cincinnati Advertising Products Co., in connection with the infringement suit under Scott Reissue patent No. 16,048, covering the application of ceramic colors to glass and other vitreous articles. A favorable decision is also reported in the lawsuit against the Cincinnati Advertising Products Co., which was tried in conjunction with the infringement or equity suit in the Western Division of the United States District Court of the Southern District of Ohio.

BRIQUETTING GLASS BATCH

In the "Question Box" Department of *Sprechsaal* for June, '39, several correspondents have given replies to the question: "Does the Briquetting of Batch still find practical application and what are the advantages and disadvantages?"

First Reply: The briquetting of batch has heretofore found application only in factories where quite a large quantity, of a constant composition was being melted. The process is of practical value particularly for continuous tank practice, because there the chambers and flues may become stopped up in a relatively short time by the repeated charging of batch. This evil condition has recently been overcome to some extent by special means of processing the batch so that the expensive practice of briquetting of batch seems on the decrease.

In addition to the advantages in the melting process, one generally reaches the conclusion that, by briquetting, the casual unmixing or segregation of the batch during storage and transport to the furnace is prevented, and therefore a more thoroughly melted and homogeneous glass will be obtained. Moreover, cleanliness is promoted by charging as briquettes so that, for example in pot practice, any contamination or coloring of neighboring pots with other colored glasses cannot take place. Without any such result to fear, the glass maker can store up a large supply of batch so that the continuous operation of the melting process is assured with a single storing.

The disadvantages are the outlay for presses, conveying devices, labor, and power. The installation works economically only when it is used fully and when cheap power is available. It scarcely comes into consideration for the smaller and middle-sized tanks.

Second Reply: The briquetting of glass batch is as yet not a generally solved problem, because not every batch is by its nature adapted to pressing. Therefore, it is used principally where several batch compositions of different sorts are being prepared, because in this case filling can be made from a mixed store of batch without danger of segregation. Similarly, the prepared batch may be safely transported and stored.

To be sure, the storing of batch in briquette form offers a chance for what must be regarded as disadvantages for the process. Among these appear additional costs for power and for the mechanical installation for the pressing. On the other hand, transportation is not materially more expensive than for loose batch.

An especially fortunate result arises because of the higher conductivity of the batch in briquette form which gives rise to more rapid melting process. Another is the accuracy of feeding charges, especially in view of the contingent requirements upon the melting space.

The questions tied up in the matter of briquetting are as yet by no means decisively answered. For example, there exists as yet no agreement upon the proper form of briquette, whether it should be pressed with or without the addition of cullet, how the difficulties arising with putting briquettes into hoppers and bins and getting them out again may be overcome, as well as other matters.

Third Reply: The briquetting of batch is finding more application in the glass industry in recent years than ever before, as can be explained by the fact that the process was originally developed and operated only for large glass plants. Following several practical expositions on the subject of briquetting batch in trade journals and the spread of information by other means, with factory people and machine builders becoming more thoroughly acquainted with the subject, the briquetting of batch has so developed that today it has come into use in a number of glass factories, at home and abroad, and is finding an increasing use.

The advantages of briquetted batch as compared with loose batch are of various kinds. It stops all dusting, leakage, and segregation during the course of transportation of the batch from the mixing room to the furnace. As a consequence, annoyance to the workmen and litter in the factory caused by the batch are eliminated. Moreover, by the elimination of dust, the entire glass furnace, that is, the super-structure with its crown and ports as well as the regenerators with their checker bricks are essentially protected, so that their effective life is prolonged. Economies arise because of the prevention of the loss of batch; and, because segregation is stopped, the batch remains homogeneous during transport so that a better glass will be melted, and the melting process also will be accelerated.

Further speeding up of the melting process arises from the closer packing of the batch, resulting in reduced volume and reduced surface of the batch. Because of the reduced volume of briquetted batch, smaller storage space will be required, and transport and charging can be accomplished more quickly, which saves wages and also reduces the heat loss. Besides, briquetted batch may be handled with simpler arrangements for carriage and conveyers to the glass furnace than is possible for loose batch.

Over against these advantages, we must place the disadvantages that either the cullet cannot be briquetted along with the batch, or else the cullet must be thoroughly crushed, which gives rise to considerable expense. This difficulty has been overcome by briquetting the batch by itself and charging the cullet separately. When cullet out of the same factory is being used, these can be charged simultaneously, or one after the other; but when cullet of outside origin is used, it becomes necessary to charge the briquetted batch and the cullet together, which is indeed quite feasible. Installation for briquetting gives rise especially to certain construction costs and also to investment and operating costs. However, the briquetting of batch must be valued as technical progress which brings noteworthy economies in its train.

The American Viewpoint

For the purpose of securing an American viewpoint, the foregoing body of European opinion on briquetting of batch was submitted to Mr. F. G. Schwalbe, a thorough student of the briquetting developments in American glass plants. His comments follow.—The Editor.

The use of briquetted batch in American glass fac-

tories has brought forth many worthwhile advantages and the favorable results claimed by European users correspond to the benefits obtained from installations made in this country. Several forms of briquettes are now in use, ranging from the small 3-oz. size, 2½ in. square and made on the roll type of machine, to briquettes of large size made on slightly revamped brick-pressing machines. Some development has also been accomplished in the utilization of machinery that extrudes the batch continuously through a die-head.

The factor of relatively large capital expenditure mentioned by European users is not as important to American glass manufacturers in the consideration of the briquette method of batch handling. The reason for this state of affairs is that state health laws now make it necessary to revamp many existing batch plants at costs equal to or greater than the investment required to adopt briquetting.

European practice seems to favor the use of hydrated lime as a binding material. Another interesting development, when raw lime batches are used, is the addition of water to the batch, whereupon the re-crystallization of the soda ash provides a binding medium for the briquette.

The composition of the batch is a very important consideration in the success of a briquetting operation and a careful study of the batch compositions required in any given plant should be made, therefore, before any installation of briquetting equipment is undertaken.

The size and shape of the briquette is important. The small briquette, most commonly used in the United States, is most satisfactory from the standpoint of handling, storage, charging and melting. Most American plants now briquette the batch without the addition of cullet.

Necessary developments to overcome present difficulties will include a low-cost binder that can be universally used for all types of batches and suitable briquetting equipment that can be operated without excessive maintenance cost.

G.E. PHYSICIST DEVISES NEW REFRACTOMETER

A simple instrument for measuring the refraction index of glass has been devised by Frank Benford of the General Electric Research Laboratory at Schenectady. Though smaller and much less costly than previous instruments, the new refractometer is accurate to two decimal places and equal to most laboratory tasks.

Principal parts of the device are a telescope and a polished metal prism. One surface of the latter is vertical and another at an angle of 45 degrees from the axis of the telescope. Springs hold the sample of glass to be tested against these faces while measurements are taken.

As the angle of tilt is fixed at 45 degrees by the prism, only the thickness of the glass and the amount of displacement of an object viewed through it need to be measured. The thickness is measured by placing the sample against the vertical face and taking comparator readings.

Attached to the tilted surface of the prism is a piece of drawing paper on which a large dot has been made with black ink. Displacement is measured by adjusting

Frank Benford is shown using his new refractometer.

the base until the cross hair of the telescope is tangent to the dot as viewed directly and then through the test glass. The difference is the optical displacement. With this data the index of refraction can be determined by slide rule and reference to tables.

For the study of thick glass, the use of a sodium lamp as an illuminant has been found advantageous. The instrument is described in the August issue of the Journal of the Optical Society. Mr. Benford is a physicist specializing in the optical field. He is a graduate of the University of Michigan.

SURFACE TENSIONS OF MOLTEN GLASS

The University of Illinois Engineering Experiment Station has just issued a bulletin on "The Surface Tensions of Molten Glass." Since surface tension data pertaining to molten glass is singularly lacking, notwithstanding their great importance, this 50-page bulletin should prove a valuable addition to the literature on glass technology. This publication is divided into two parts: one on surface tensions of molten glass, prepared by Cullen W. Parmelee, Professor of Ceramic Engineering at the University of Illinois, and his research graduate assistant, Kenneth C. Lyon. The second part, which deals with surface tensions of soda-lime-silica melts, was prepared by Professor Parmelee and Cameron G. Harman, Instructor in Ceramic Engineering.

"The Surface Tensions of Molten Glass," which is priced at 55 cents, may be obtained by writing The Engineering Experiment Station, University of Illinois, Urbana, Ill.

TARIFF COMMISSION ISSUES REPORT ON INCANDESCENT ELECTRIC LAMPS

A report covering the economic aspects of the production and distribution of incandescent electric lamps and glass bulbs in the United States, Japan, Germany, and several other countries has just been issued by the United States Tariff Commission. The United States leads the world in the production and use of incandescent lamps, and the bulk of its consumption is supplied by domestic manufacturers. Production in the United States amounted to 807 million lamps valued at 71 million dollars in 1937, and to 740 million lamps valued at 63 million dollars in 1938.

ORIGINAL 200-INCH DISC GOES ON PUBLIC EXHIBIT

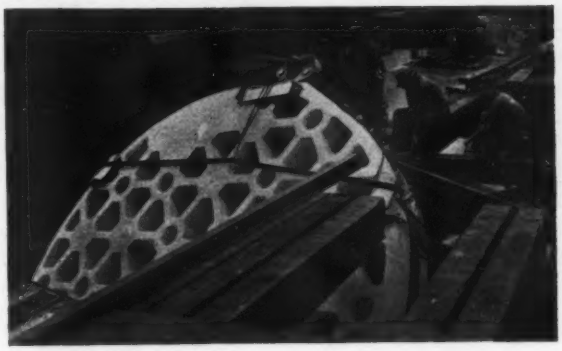
The original 200-inch telescope disc, the largest piece of glass in the world, was placed on exhibit in a public square in Corning, N. Y., after it had been moved from the plant of the Corning Glass Works. Six days were required to move the enormous disc a distance of six city blocks and elaborate preparations had to be made to guard against accident in transporting the 20-ton giant which is in the shape of a huge glass disc nearly 17 feet in diameter and 27 inches thick. It is translucent and its color is an opalescent bluish white.

Glass men will recall that this was the first of the 200-inch discs cast for use at the Mount Palomar Observatory in California, and which was eventually discarded in favor of a disc which was poured later. The reason for this was certain imperfections in the original disc. Some of the 113 cores which were to form the gigantic pattern of heights and hollows in the back of the disc began to pop up to the surface of the molten glass. The pouring heat of 2,300 degrees F. was so intense that the steel anchor rods which held the cores in place were oxidizing or melting away. The floating cores were fished out but the molten glass immediately filled in the voids where hollows were to have been formed by the cores. The glass was annealed but it was found that the cores would have to be drilled out, so to be on the safe side Corning's scientists decided to pour another disc for Mount Palomar.

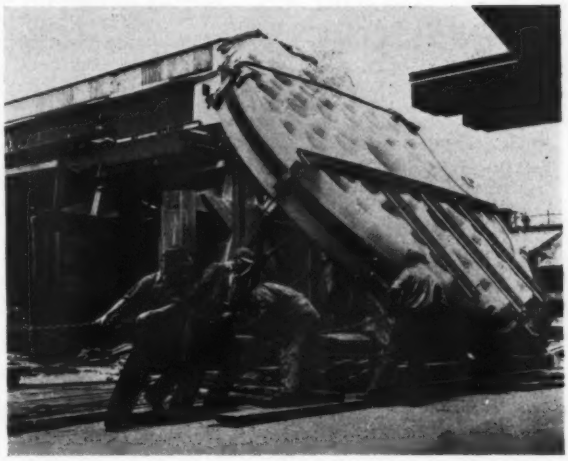
The most interesting factor in the history of this original disc lies in the great interest taken in it by the general public when they happened to be motoring through Corning.

Since 1934, the first 200-inch disc has rested in a horizontal building attached to "A-Factory" of Corning Glass Works, on the bank of the Chenung River. Because its location was back of a battery of huge tank furnaces which operate on a heavy production schedule day and night, it was found impractical to take guests in great numbers around back of the furnaces and through a busy glass blowing area where scores of gass blowers were moving with blow-pipes and punties bearing red hot glass. (*Continued on page* 342)

Leaving the scene of its birth. The giant telescope eye passes through the gateway of the Corning Glass Works.



A railroad trestle had to be opened up to make way for the giant disc to pass.



And still another trestle had to be removed. Using methods similar to those employed in moving houses, a squad of workmen eased the disc forward on three-inch steel pipe sections, which served as rollers.

Half way through its journey, the disc had a tight squeeze under a series of pipes carrying steam and gas to the Corning Glass Works.

CURRENT PRICES OF GLASS-MAKING MATERIALS

FURNISHED BY PRODUCERS, MANUFACTURERS AND DEALERS

Base Materials

		Carlots	Less Carlots
Barium carbonate ($BaCO_3$), Crude, (Witherite) 90%, 99% through 200 mesh	ton	43.00	46.00
Barium sulphate, in bags	ton	19.00	24.00
Barium sulphate, glassmaker's, carlots, bulk f. o. b. shipping point	ton	15.00-16.00	18.00
Borax ($Na_2B_4O_710H_2O$)	lb.	....	....
Granulated	In bags, lb.	.0215	.027 -.0295
Powdered	In bags, lb.	.024	.0295-.032
Boric acid (H_3BO_3) granulated	In bags, lb.	.048	.054 -.0565
Calcium phosphate ($Ca_3(PO_4)_2$)	lb.	.07	.07½
Cryolite ($Na_3Al\ F_6$) Natural Greenland (Kryolith)	lb.	.0865-.0875	.0925
Synthetic (Artificial)	lb.	.0825	.0875
Feldspar—			
20 mesh	ton	11.00-13.25	
40 mesh	ton	11.50-13.75	
Granular	ton	11.75-14.00	
Semi-granular	ton	11.00-13.25	
L. C. L., (Min. 2 tons) $3.00 per ton additional plus charge for bags			
Fluorspar (CaF_2) domestic, ground, 96-98% (max SiO_2, 2½%)			
Bulk, carloads, f. o. b. mines	ton	28.00-29.00	....
In bags	ton	29.60-30.60	38.00-40.00
Kryolith (see Cryolite)			
Lead Oxide (Pb_3O_4) (red lead) (N. Y.)	lb.	.0755	....
In 5 Ton lots	lb.	....	.08
Less than 5 Tons	lb.	....	.085
Lime—			
Hydrated ($Ca(OH)_2$) (in paper sacks)	ton	8.50	8.50
Burnt (CaO) ground, in bulk	ton	7.00	....
Burnt, ground, in paper sacks	ton	9.00	9.00
Burnt, ground, in 180 lb. drums	Per drum	1.60	1.70
Kiln Dried ($CaCO_3$) 10x30 mesh	ton	1.75	....
Kiln Dried ($CaCO_3$) 16x120 mesh	ton	1.75	....
Nepheline Syenite, f. o. b. shipping point	ton	12.00-14.00	....
Potassium carbonate—			
Calcined (K_2CO_3) 96-98%	lb.	.065	.0675
Hydrated 80-85%	lb.	.055	.0575
Salt cake, glassmakers (Na_2SO_4)	ton	15.00	25.00
Soda ash (Na_2CO_3) dense, 58%—			
Bulk	Flat Per 100 lb.	.95	....
In barrels	Per 100 lb.	1.35	....
In bags	Per 100 lb.	1.10	....
Sodium nitrate ($NaNO_3$)—			
Refined (gran.) in bbls.	Per 100 lb.	....	2.50-2.90
95% and 97%			
Bulk	Per 100 lb.	1.35	....
200 lb. bags		1.415	1.44
100 lb. bags		1.45	1.475

Special Materials

		Carlots	Less Carlots
Aluminum hydrate (Al $(OH)_3$)	lb.	.029	.03½
Aluminum oxide (Al_2O_3)	lb.	.07	.09
Antimony oxide (Sb_2O_3)	lb.	.10½	.11¼
Arsenic trioxide (As_2O_3) (dense white) 99%	lb.	.03	.03½
Barium nitrate ($Ba(NO_3)_2$)	lb.	....	.07¾
Pyrophyllite, (20% Al_2O_3)	ton	9.00	12.00
Sodium fluosilicate (Na_2SiF_6)	lb.	.035-.04	.04¼-.05
Tin Oxide (SnO_2) in bbls.	lb.	....	.52
Titanium Oxide (ceramic grade)			
In bags	lb.	.12	.12¼-.12¾
In barrels	lb.	.12¼	.12½-.13
Zinc Oxide (ZnO)			
American process, Bags	lb.	.06½	.06½
White Seal, 150 lb. bbls.	lb.	.08¾	.09
Green Seal bags	lb.	.08	.08¼
Domestic White Seal bags	lb.	.08½	.08¾
Red Seal, bags	lb.	.07½	.07¾
Zircon			
Refined Granular (Milled .01-.02c higher)		.06½	.07-.08
Commercial. Gran. (Milled .01¼-.01½ higher)		.0275	.0325

Coloring Materials

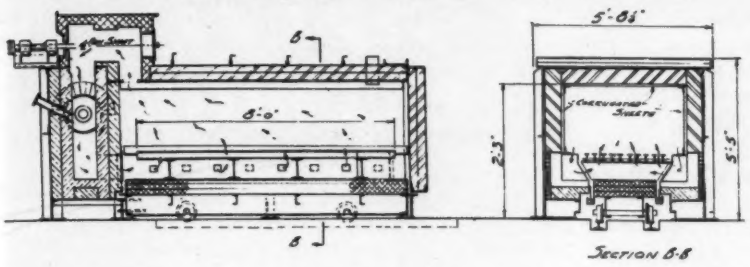
		Carlots	Less Carlots
Barium selenite ($BaSeO_3$)	lb.	....	1.40-1.60
(Commercial. 25% Selenium)	lb.	....	.85
Cadmium sulphide (CdS)	lb.	....	.75-.80
Chromite (99% through 200 mesh)	ton	35.50	40.00
Chromite ore (air floated)	ton	55.00	58.00-73.00
Cerium hydrate—			
100 lb. drums and 600 lb. barrels	lb.	....	.60
Chrome Oxide Green. 400 lb. bbls.	lb.	....	.22-.26
Cobalt oxide (Co_2O_3)			
In bbls. 350 lbs. or more,	lb.	....	1.67
Less than 350 lbs.,	lb.	....	1.77
Copper oxide—			
Red (Cu_2O)	lb.	....	.165
Black (CuO)	lb.	....	.16-.17
Black prepared	lb.	....	.22
Iron Oxide—			
Red (Fe_2O_3)	lb.	....	.0425-.09
Black (Fe_3O_4)	lb.	.04½	.09
Iron Chromate	lb.	....	.035-.05
Lead Chromate ($PbCrO_4$) in bbls.	lb.	....	.145
Manganese, Black Oxide			
In Paper bags	ton	47.50	50.50-54.50
In Burlap bags	ton	49.25	51.75-56.75
In Casks	ton	51.50	54.00 59.00
Neodymium oxalate, 50 lb. drums	lb.	....	3.50
Nickel oxide (Ni_2O_3), black	lb.	....	.35-.40
Nickel monoxide (NiO), green	lb.	....	.35-.37
Potassium bichromate ($K_2Cr_2O_7$)—			
Crystals	lb.	.08¾	.09-.09¼
Powdered	lb.	....	.09¼-.09¾
Potassium Chromate (K_2CrO_4) 100 lb. kegs	lb.	....	.27
Powder blue	lb.	....	.17-.2125
Rare earth hydrate—			
100 lb. drums	lb.	....	.35
325 lb. barrels	lb.	....	.30
Selenium (Se) In 100 lb. lots	lb.	....	1.75
In lesser quantities	lb.	....	1.85
Sodium bichromate ($Na_2Cr_2O_7$)	lb.	.06¾	.07-.07¼
Sodium chromate (Na_2CrO_4) Anhydrous	lb.	.08¼	.08¾-.08¾
Sodium selenite (Na_2SeO_3)	lb.	....	1.50-1.65.
Sodium uranate (Na_2UO_4) Orange	lb.	....	1.75-1.80
Yellow	lb.	....	1.75-1.80
Sulphur (S)—			
Flowers, in bbls.	Per 100 lb.	3.35	3.70-4.10
Flowers, in bags	Per 100 lb.	3.00	3.35-3.75
Flour, heavy, in 250 lb. bbls.	Per 100 lb.	2.90	3.25-3.65
Uranium oxide (UO_3) (black, 96% U_3O_8) 100 lb. lots. Black	lb.	....	2.65-2.75
Yellow orange	lb.	....	1.75-1.80

Polishing Materials

		Carlots	Less Carlots
Emery, Turkish	lb.	.063	.07
Pumice Stone,			
American Ground Italian FFF, FF, F	lb.	....	.03
0, 0½, ½, 1.	lb.	....	.03¼
Putty Powder	lb.	....	.38-.42
Rotten Stone, (Domestic)	lb.	....	.02
Rouge, Red	lb.	....	.14
Black	lb.	....	.16

EQUIPMENT AND SUPPLIES

SURFACE COMBUSTION'S NEW MOULD HEATING OVEN



A new glass mould heating oven of the car-bottom type has recently been announced by the Surface Combustion Corporation, Toledo, Ohio. The new oven employs the principle of recirculation heating, the same as used in S-C continuous lehrs, the hot gases being forced by means of a fan to flow up through the car and the moulds loaded thereon. After the hot gases have given up a portion of their heat to the moulds, they are picked up by a recirculating fan, mixed with fresh products of combustion and again recirculated.

A typical oven for handling 2,500 pounds of moulds per charge has a car 8 ft. long by 32½ in. wide. The overall dimensions of this oven are 12 ft. by 5½ ft. In practice, it is stated that 2,500 lbs. of moulds have been heated to 900 deg. F. in 1½ hours with the oven at temperature. This rate of heating minimizes the condensation which occurs below approximately 180 deg. F. The fast rate of heating is attributed to the fact that recirculation of the hot gases causes the heat to be transferred by convection. The uniform sweeping of hot gases over the mould surfaces is said to result in exceptionally uniform heating of all sizes, shapes and weights.

The heating and cooling cycle is automatically controlled, this feature making the oven also adaptable for reannealing or for special decorating.

NEW TUBING MACHINE

Louis Plumbo, world sales representative for various types of glass-making equipment, reports on some of the qualities of the new "Danner" automatic glass tubing machine which can operate in a continuous furnace or in a day tank on either a large or small production schedule. With standard equipment, it can manufacture any size of tubing up to one inch in diameter, and changes in the size of tubing can be made immediately while the machine is in operation. Mr. Plumbo advises that the wall thickness of the tubing can also be changed or regulated while the machine is in operation.

TAYLOR APPOINTS

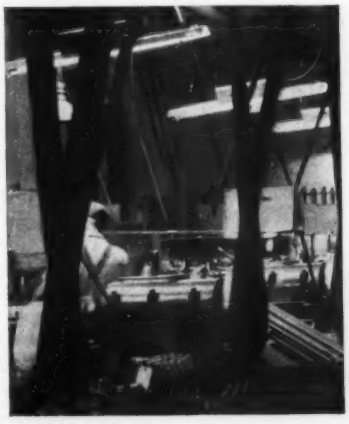
The Chas. Taylor Sons Co., Cincinnati, manufacturers of P. B. Sillimanite refractories, has appointed K. I. Gannon to the sales staff of their St. Louis, Mo., office to succeed his father who died suddenly last May. This company has also added Felix Fraulini, M. S., University of Illinois, and Donald R. Smith, M. S., University of Alabama, to their technical staff as ceremic engineers. These latter appointments are in accordance with the company's policy of research development with refractory material relating to glass plant problems.

MOVES OFFICES

The Columbia Alkali Corporation reports that their executive sales offices have been moved from Barberton, Ohio, to 30 Rockefeller Plaza, New York City. All correspondence to the sales offices of this company should be addressed to New York City after September 1st.

TRANSMISSION BELT

After three years of research and experimentation, Hewitt Rubber Corporation. Buffalo, is now manufacturing an all-Neoprene Friction Surface Transmission Belt. This new product is the result of a demand for belting that will withstand the destructive action of mineral oils on the rubber friction compounds. After considerable research and experimentation, Hewitt technicians have developed its Duroil Hewprene Transmission belt to meet these conditions. There is no natural rubber in these belts, the friction and skim compounds, being of Neoprene synthetic oil proof material.



Hewprene (Hewitt trade name for products containing Neoprene, a Du Pont "base") friction and skim coat of rubber between all plies provides high flexing life over high speed pulleys. The friction and skim coat protect the cotton duck against wear, ply separation, and softening from oil at high temperatures.

In every factory and field test, Hewprene Transmission belts when exposed to oil are reported to require less take-up and maintenance supervision than rubber belts due to low stretch by virtue of their oil proof quality. They hold wire fasteners exceptionally well under the severest working conditions.

HAYS IMPROVED AUTOMATIC GAS ANALYZER

The Hays Corporation, Michigan City, Ind., has recently announced an improved model of their automatic flue-gas analyzer, known as the Orsatomat. The major change has been made in the tilting analyzing unit which is now made of a transparent plastic instead of hard rubber as formerly. The new

unit is also said to be smaller, lighter in weight and more compact.

The analyzing unit is mounted in a pressed steel case, together with a draft measuring and indicating unit, as shown in the accompanying illustration. Analyzing and indicating units are both removable. If desired, a flue gas thermometer may be fitted inside the case.

The Orsatomat is a true Orsat analyzer, since it employs the principle of volumetric measurement and chemical absorption. To obtain an analysis of a sample of combustion gas the operator pulls out a small rod that protrudes from the side of the case, aspirates the gas into the unit by means of a rubber bulb, and pushes in the rod. The percentage of CO_2 in the sample is immediately indicated on the scale in the front of the case. The operation is said to take about one-half minute.

ORIGINAL 200-INCH DISC ON EXHIBIT

(*Continued from page* 339)

Judging by the applications early received, 30,000 people might come to see the disc the first year and in succeeding years this number might have grown in geometric proportions—so, as a matter of policy, in was found necessary to bar all visitors from "A-Factory" except technical men on special assignments.

The citizens of Corning felt increasingly regretful that the town could not respond to the demands of visitors to see the disc. So it was decided to place the disc on exhibit as a civic project. The disc was moved through the streets on a long under-slung trailer truck of the type used at Boulder Dam. It was supported in a heavy steel cradle inclined at an angle of about 60 degrees and transported to the city square near the historic stone clock tower erected in 1884 in honor of Erastus Corning, founder of the town. A dome shaped museum building is now being built up around it to protect it from the weather and souvenir hunters.

NEW FIBERGLAS DUST-STOP FILTER

Introduction of a new type Dust-Stop air filter for industrial and commercial use, utilizing the new fiberglas material which is now employed extensively for air cleaning purposes, has been announced by the Owens-Corning Fiberglas Corporation, of Toledo, Ohio.

The new filter is one inch thick and is to be used with one or more like filters in series. It has been designed to provide operating economy in applications which are supervised carefully and where the fiter is changed at frequent intervals. It is an adhesive-coated, impingement type of filter, non-cleanable and designed to be replaced when filled with dust.

An original and exclusive feature of Dust-Stop filters is used in the production of the new article. This is the progressive pack of varying size fibers. Two mats are used, the coarse fibers, of from .009 to .011 inch in diameter, being at the intake face, and the finer fibers, of from .005 to .006 inch in diameter, being at the discharge face, but the coarse fiber mat accounts for approximately one-third and the fine fiber mat approximately two-thirds of the bulk of the complete pack. Very long fibers are used and are thoroughly interlaced in the process of manufacture in order to form a uniform mat. After spraying with a binder, and drying, the semi-rigid mat is subjected to the application of an adhesive to catch dust.

The filter is faced with stamped metal grills and is bound on the edges with a special fiberboard frame. Tricresyl phosphate is used as the dust-catching adhesive instead of the usual filter oils because, unlike oils, it cannot be ignited by a flame held against the filter. When heated, this adhesive gives off a gas that tends to smother flame, acting much like ordinary fireproof salt, but it has a negligible evaporation and will not charge the air with vaporized adhesive. The fiberglas material from which the filter is constructed is also fireproof.

The new type filter follows the purpose of the other Dust-Stop filters in that it is designed for maximum effectiveness in intercepting and retaining the ordinary "nuisance" dusts commonly found in buildings and business establishments, such as the dusts which damage and soil goods in stores and shops, darken draperies and wall coverings and cause waste in the manufacture of fine products. It has been found that these filters remove air borne pollen, such as produce hay fever, to such an extent that persons working in palnts and offices where they are utilized have found noticeable relief.

IMPROVEMENT IN GLASS INDUSTRY DURING HALF OF 1939

Activity in the United States glass industry increased during half of 1939, as compared to the corresponding period of last year, according to Specialties Division of the Department of Commerce.

Higher production levels, increased exports, and decreased imports were among the factors noted. Plate glass output was more than twice as great as during the first six months of 1938, window glass production increased 72 per cent, and glass container production was up 17 per cent. According to trade estimates, illuminating glassware sales were 25 per cent above last year's level; tableware lines are reported to have experienced increases up to 12 per cent.

Decreased foreign competition traceable to unsettled conditions in Japan and Germany are reflected in trade statistics. United States imports of glass during the first 6 months of 1930 were slightly below the 1938 level despite the fact that abnormally large shipments were imported during April of this year to escape the countervailing duty levied on German goods. Exports during the period under review were 9 per cent above the comparative figures for 1938.

FOUNDRYMEN TO MEET

The board of directors of the American Foundrymen's Association at its recent meeting accepted the invitation from Chicago to hold its 1940 convention in that city on May 6-10 inclusive. In conjunction with the convention there will be a major exhibit of foundry equipment and supplies in the International Amphitheatre of the Union Stock Yards and Transit Company.

● WANTED—SALESMAN for Glass Trade, to sell fluxes, vitrifiable colors, oils, pastes, supplies, etc. State age, education and experience in first letter application. Box 32, The Glass Industry.

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Industrial Division
Ransome Concrete Machinery Co.
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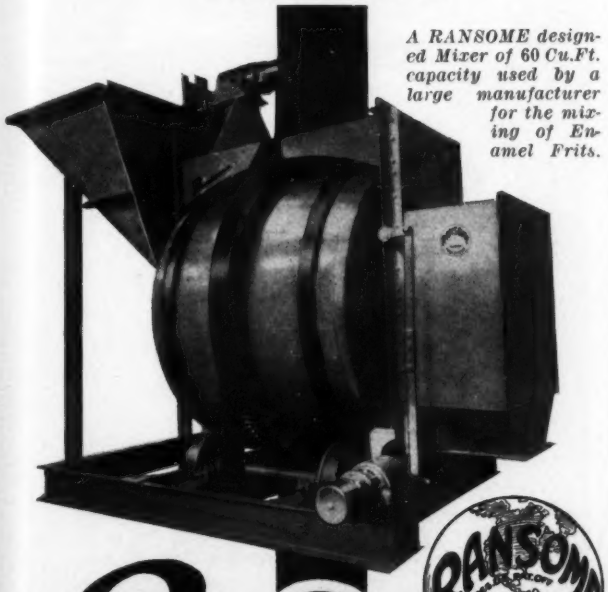

A RANSOME designed Mixer of 60 Cu.Ft. capacity used by a large manufacturer for the mixing of Enamel Frits.

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INDUSTRIAL MIXERS

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● Today, looking into the future and finding the answers to tomorrow's problems is just a matter of sound, thoughtful research. In glass and ceramics, it means developing chemicals and colors that will be able to meet tomorrow's requirements . . . it means *anticipating* new products, new uses, new advancements —and being *ready* for them.

When you run into a tough problem involving colors or chemicals—remember that Drakenfeld research may have found the answer for you already . . . and that Drakenfeld technologists are ready to serve you quickly, willingly, without any obligation whatever on your part. Just write.

NEW ACID, ALKALI AND SULPHIDE RESISTANT COLORS AND ENAMELS FOR GLASS

METALLIC OXIDES AND CHEMICALS

Alumina	Manganese Dioxide
Antimony	Magnesium Carbonate
Arsenic	Neodymium Oxalate
Barium Carbonate	Nickel Oxides
Bone Ash	Nickel Sulphate
Cadmium Oxide	Polishing Rouges
Cadmium Sulphide	Powder Blue
Cerium Hydrate	Putty Powders
Chrome Oxide Green	Rare Earths
Cobalt Oxide Black	Rutile Powdered
Copper Carbonate	Selenium
Copper Oxides	Sodium Selenite
Frosting Compounds	Sodium Uranate
Glass Decolorizers	Titanium Oxide
Iron Chromate	Uranium Oxide
Iron Oxides	Whiting
Iron Sulphide	Zinc Oxides
Lead Chromates	Zirconium Oxide

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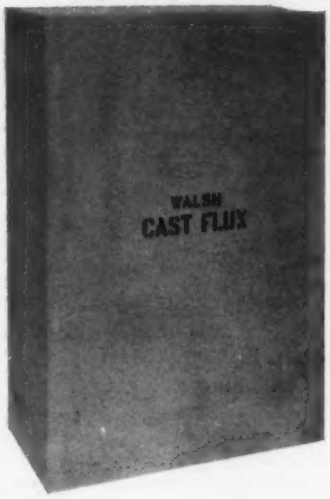
WALSH CAST-FLUX



The Vacuum-cast flux block of superior quality.

Walsh Cast-Flux blocks are machine-trued to exact size and shape after burning.

THEY LAST LONGER

The excellent results obtained in numerous tanks melting various types of glass has definitely established the efficiency and economy of Walsh Cast-Flux blocks.

Walsh Cast-Flux has a dense, uniform structure; it is burned at higher temperatures, is thoroughly bonded and possesses a low coefficient of expansion.

Walsh Cast-Flux blocks meet the most rigid requirements for tanks operating at higher temperatures . . . they insure greater tonnage, higher quality glass, freedom from defects, longer life and maximum economy.

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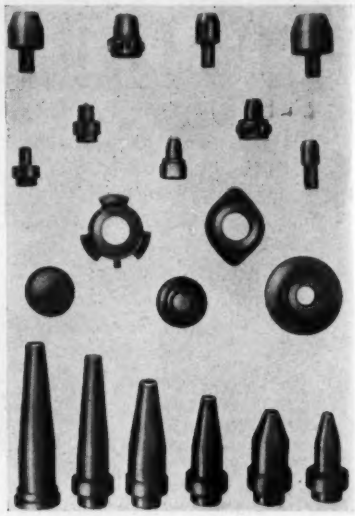
Annealed



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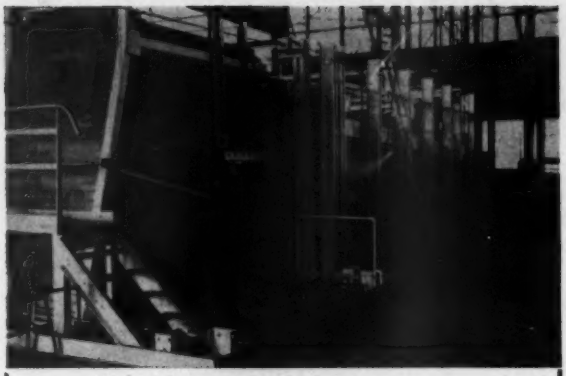

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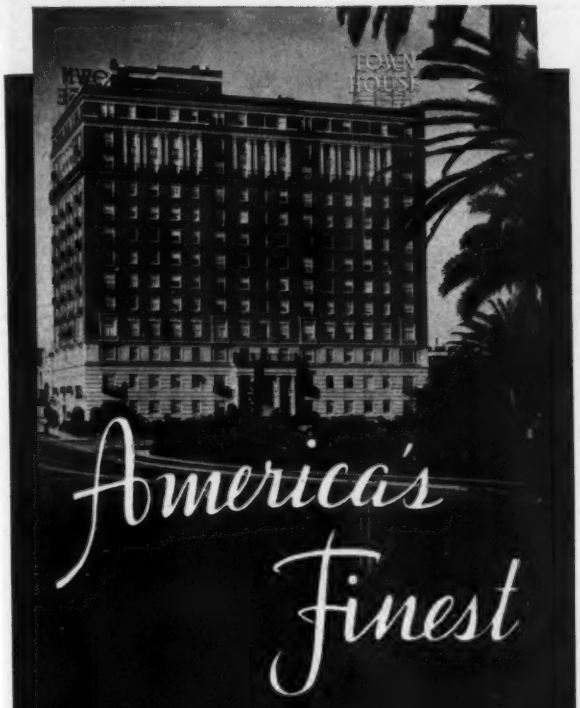

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